90. **Proposed by H. S. VANDIVER, Bala, Penn.**

Prove that it is always possible to find an infinite number of positive integral values of x, y and z, such that the relation $z^2=x^2+bxy+cy^2$ is satisfied, b and c being any integers whatever.

*** Solutions of these problems should be sent to J. M. Colaw not later than Nov. 10.

AVERAGE AND PROBABILITY

113. **Proposed by F. P. MATZ. M. Sc., Ph. D., Professor of Mathematics and Astronomy, Defiance College, Defiance. O.**

A given cube is cut by a plane in such a manner that the *lines of section* form a *regular* hexagon. What is the mean area of this hexagon?

114. **Proposed by LON C. WALKER, A. M., Assistant Professor of Mathematics, Leland Stanford Jr.University, Palo Alto, Cal.**

If a regular polygon of n sides be placed at random on another equal polygon, show that the chance that the center of the first will fall on the second polygon is $\dfrac{\pi}{2[\pi+n\tan(\pi/n)]}$

*** Solutions of these problems should be sent to B. F. Finkel not later than Nov. 10.

MISCELLANEOUS.

114. **Proposed by J. SCHEFFER. A. M., Hagerstown, Md.**

When the sun's declination was 15° N. his altitude was found to be 20°, and after an hour's interval his altitude was found to be 31°. Required the latitude of the place of observation.

115. **Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, O.**

Determine geometrically where to stand so as to be able to throw a stone over a tree with the *minimum* velocity.

116. **Proposed by J. A. CALDERHEAD, B.Sc., Professor of Mathematics in Curry University, Pittsburg, Pa.**

Prove that

$$-\,|\,\alpha_1\beta_2\gamma_3\,|^2\begin{vmatrix} a & b & c\\ b & d & e\\ c & e & f\end{vmatrix}^2=\left\|\begin{array}{ccc}
\begin{vmatrix} a & b & c & \alpha_1\\ b & d & e & \alpha_2\\ c & e & f & \alpha_3\\ \alpha_1 & \alpha_2 & \alpha_3 & 0\end{vmatrix} & \begin{vmatrix} a & b & c & \alpha_1\\ b & d & e & \alpha_2\\ c & e & f & \alpha_3\\ \beta_1 & \beta_2 & \beta_3 & 0\end{vmatrix} & \begin{vmatrix} a & b & c & \alpha_1\\ b & d & e & \alpha_2\\ c & e & f & \alpha_3\\ \gamma_1 & \gamma_2 & \gamma_3 & 0\end{vmatrix}\\
\begin{vmatrix} a & b & c & \beta_1\\ b & d & e & \beta_2\\ c & e & f & \beta_3\\ \alpha_1 & \alpha_2 & \alpha_3 & 0\end{vmatrix} & \begin{vmatrix} a & b & c & \beta_1\\ b & d & e & \beta_2\\ c & e & f & \beta_3\\ \beta_1 & \beta_2 & \beta_3 & 0\end{vmatrix} & \begin{vmatrix} a & b & c & \beta_1\\ b & d & e & \beta_2\\ c & e & f & \beta_3\\ \gamma_1 & \gamma_2 & \gamma_3 & 0\end{vmatrix}\\
\begin{vmatrix} a & b & c & \gamma_1\\ b & d & e & \gamma_2\\ c & e & f & \gamma_3\\ \alpha_1 & \alpha_2 & \alpha_3 & 0\end{vmatrix} & \begin{vmatrix} a & b & c & \gamma_1\\ b & d & e & \gamma_2\\ c & e & f & \gamma_3\\ \beta_1 & \beta_2 & \beta_3 & 0\end{vmatrix} & \begin{vmatrix} a & b & c & \gamma_1\\ b & d & e & \gamma_2\\ c & e & f & \gamma_3\\ \gamma_1 & \gamma_2 & \gamma_3 & 0\end{vmatrix}
\end{array}\right\|$$

[From *Muir's Determinants*].

*** Solutions of these problems should be sent to J. M. Colaw not later than Nov. 10.